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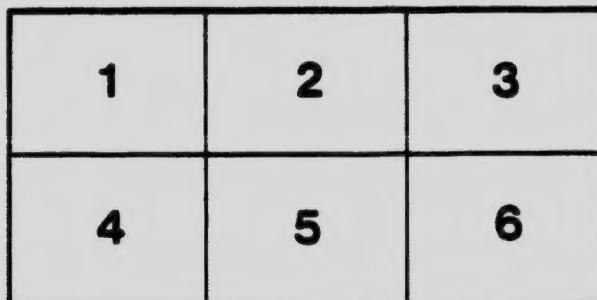
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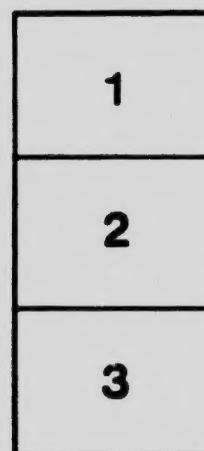
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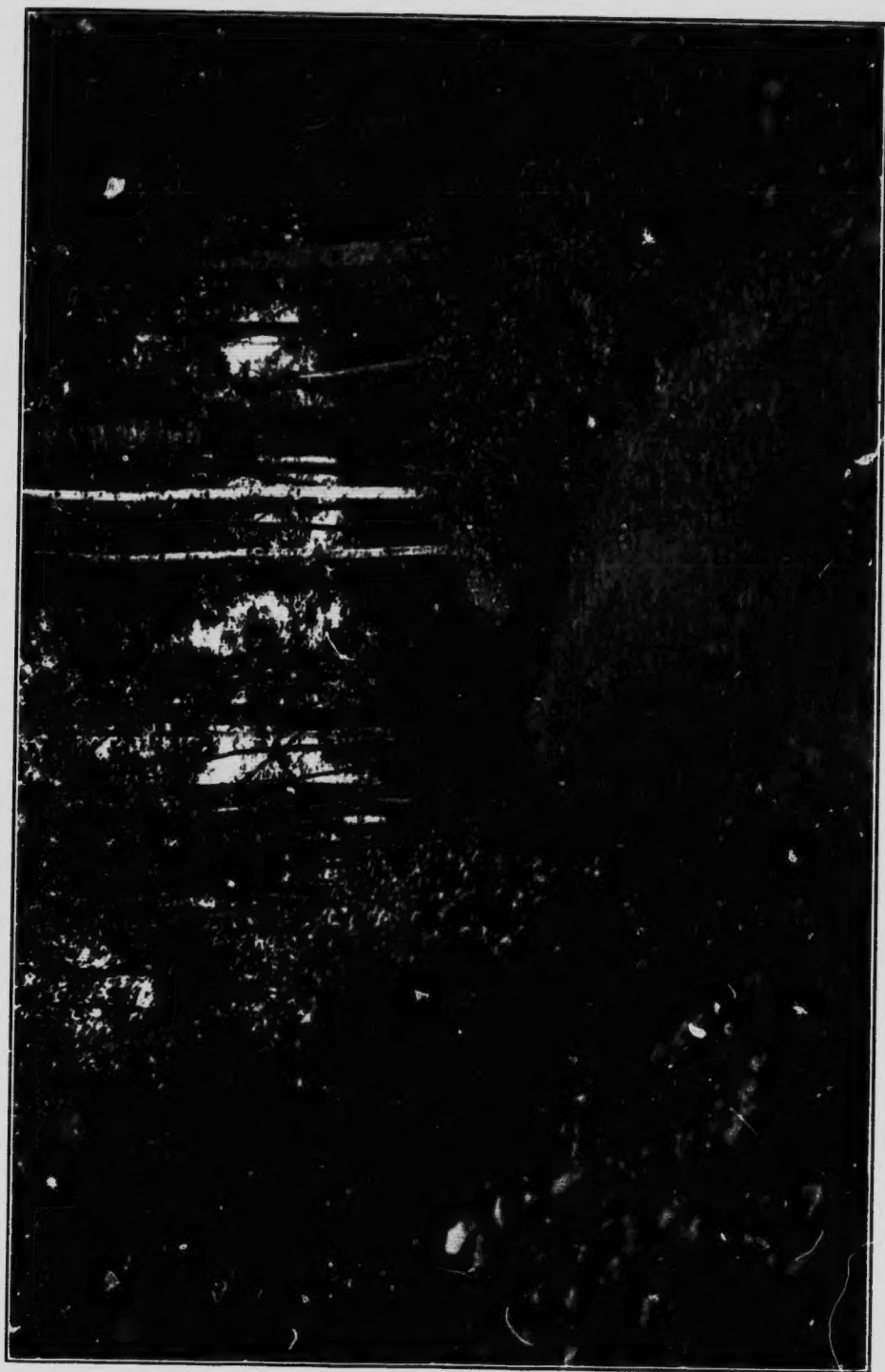


Plate 1.—Poplar Type near Sprague, Man.
The dense undergrowth here indicates favorable growth conditions.

(Photo E. H. Finlayson)

DEPARTMENT OF THE INTERIOR, CANADA

HON. W. J. ROCHE, Minister; W. W. CORY, Deputy Minister

FORESTRY BRANCH—BULLETIN No. 45.

R. H. CAMPBELL, Director of Forestry.

TIMBER AND SOIL
CONDITIONS

OF

SOUTHEASTERN MANITOBA

L. C. TILT, B. Sc. F.

OTTAWA

GOVERNMENT PRINTING BUREAU

1914

62210--2

LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
FORESTRY BRANCH,

OTTAWA, July 15, 1913.

SIR,—I beg to submit herewith a report by Mr. L. C. Tilt, B.Sc. F., on the "Timber and Soil Conditions of Southeastern Manitoba" and to recommend its publication as Bulletin No. 45 of this Branch.

The report outlines the result of work in the summer of 1912 by a party of which Mr. Tilt was the head. The object of the party was to investigate the soil and other conditions of part of Southeastern Manitoba, with a view of ascertaining whether the country was suitable for farming or would be of greater value if kept for forest growth. The country examined included the valleys of the Whitemouth and Winnipeg rivers, and comprised, roughly, the easternmost nine ranges, from the international boundary to a few miles north of the Winnipeg river—the forest region extending east from the Brokenhead river.

A considerable proportion of the country was found suitable for a forest reserve, and a map is included in the bulletin showing this tract. Closer examination, however, will be necessary to determine the final boundary of the reserve.

By far the greatest part of the country was found to be of the muskeg type, much of which may, as the result of further examination and experiment in dealing with country of this class, be found suitable for agriculture. About twenty per cent of the 3,816 square miles of country examined (not including the Laurentian area) is poplar land, which after being cleared will be suitable for farming.

A comparatively small part of the entire tract mentioned above—a total of 287 square miles, or some seven per cent of the area—consists of jack pine land, which, being sandy and unfit for farming, is recommended to become part of the forest reserve.

The Laurentian country is also forest land and should be included in the reserve; but further examination is necessary to determine the boundaries of the territory to be included.

Your obedient servant,

R. H. CAMPBELL,
Director of Forestry.

W. W. CORY, Esq., C.M.G.,
Deputy Minister,
Department of the Interior,
Ottawa.

DEPARTMENT OF THE INTERIOR,

FORESTRY BRANCH,

OTTAWA, March 30, 1913.

SIR,—I beg to submit herewith a report on the work of the Eastern Manitoba Boundary Survey during the summer of 1912.

I have the honour to be, sir,

Your obedient servant,

L. C. TILT.

R. H. CAMPBELL, Esq.,
Director of Forestry,
Department of the Interior.
Ottawa, Canada.

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TIMBER AND SOIL CONDITIONS IN SOUTHEASTERN MANITOBA.

During recent years, Manitoba has shared in the rapid progress in settlement made by Central Canada in general. Long regarded, along with the other Prairie Provinces, as fitted for little but the production of furs and game, the province received but little settlement until the purchase of Rupert's Land by the Dominion Government in 1870.

Even then, for years settlers came in comparatively small numbers. From 25,228 in 1871 the population increased to 62,260 in 1881 and again to 152,506 in 1891. In 1901, the province had 255,211 inhabitants, which number had in 1911 increased to 455,614, and in 1913 was estimated at 500,000.

Nearly all the land was acquired under the homestead law, title being given for 160 acres, after the homestead duties were performed.

In 1885 the "Swamp Lands" (see appendix) were transferred to the Provincial Government and largely disposed of at about \$10 per acre on very easy terms. Over 400,000 acres of this "Swamp Land," which has been retransferred to the Dominion Government, are within the district described in this report.

Since the true agricultural value of this section of southeastern Manitoba had been reported on only in a general way, it was decided by the Department of the Interior to make a survey to determine the soil conditions, as well as the timber conditions, existing there, and at the same time determine the agricultural fitness of the district.

OBJECT OF SURVEY.

The object of the survey was to determine and report on the soil and timber conditions and suggest the most feasible disposal of the various types of land either for a forest reserve or for agriculture.

RESUME OF SUMMER'S WORK.

Pursuant to instructions of April 17, from the Director of Forestry, I left Ottawa on May 18, accompanied by Mr. F. S. Newman. We spent several days ascertaining conditions along the Canadian Pacific railway, east of Whitemouth, and along the Canadian Northern railway from Marchand southeast to the United States boundary.

It was then determined to make a quick reconnaissance of the country in the vicinity of the Whitemouth and Winnipeg rivers, using these water-courses as base-lines. Accordingly we left Whitemouth lake by canoe on June 1, and travelled northward down stream. A rough reconnaissance was made of the country adjacent to and a few miles back from the river. This course was followed as far north as lake Winnipeg and also around Lac du Bonnet and up the Oiseau (Bird) river for 18 miles from its mouth.

Two men and a team were then procured at Sprague, near the United States boundary, to work north and west, and make a more detailed survey. Thus we travelled to the Dawson road and then down the Whitemouth river, determining, by the

"quarter-acre circular plot" method, the nature of the soil and timber. We proceeded north to the Canadian Pacific railway, where the party was broken up on account of Mr. Newman having to return to resume his studies at the Faculty of Forestry, University of Toronto. With the assistance of Mr. W. Wardrope, the country was finished in a similar manner as far north as the Winnipeg river and then about ten days were spent in the Laurentian country near Cross lake on the Canadian Pacific railway.

After finishing the field work, I spent about a week in Minnesota near Duluth and International Falls inspecting some of the drainage operations being carried on there, leaving there for Ottawa, where I arrived on November 7.

DESCRIPTION OF SURVEY AND SOURCE OF DATA.

Since there was such a large territory to cover (over 3,500 square miles), and a limited time in which to do the work, and as the party, which comprised only two members, had to work under the unfavourable conditions caused by the well-nigh impassable muskegs, it was necessary to work on a large scale. Therefore, this is merely a preliminary study of conditions here, and does not by any means pretend to take the place of a working-plan report.

The map accompanying this report was compiled from the data procured on the survey over the country which was covered. In the muskeg country to the east of this the data were procured from the reports of the township surveys by Surveyors Mulloy, Pearce, Johnston and Fitzgerald, modified by the notes taken on the parts of that country which were covered.

Plant Region.—Southeastern Manitoba has not the outstanding features peculiar to any of the plant regions as they are classified. It is on the boundary of three regions, viz., "The Southern Forest," "The Northern Forest" and "The Mixed Prairie and Woodland" and shows conditions, in this district, found in each of these regions.

Tree Species.—Arranged in order of importance in this district these are:—

- Black spruce—*Picea mariana*.
- Tamarack—*Larix laricina*.
- Jack pine—*Pinus Banksiana*.
- Poplar—*Populus tremuloides*.
- Paper birch—*Betula alba* var. *papyrifera*.
- White cedar—*Thuja occidentalis*.
- White spruce—*Picea canadensis*.
- Black ash—*Fraxinus nigra*.
- Balsam poplar—*Populus balsamifera*.
- Balsam fir—*Abies balsamea*.
- American elm—*Ulmus americana*.
- Scrub oak—*Quercus macrocarpa*.
- Manitoba maple—*Acer Negundo*.
- Red pine—*Pinus resinosa*.
- White pine—*Pinus strobus*.

Climate.—The climate is practically the same as that of the rest of southern Manitoba, except that it is less subject to winds than the more level prairie portions to the west. Although typically a continental climate, with an abundance of sunshine throughout the year and extremes of heat in summer and cold in winter, with

an average annual precipitation of 15 to 20 inches, it is still well suited to the growth of all cultivated plants common to this country, with the possible exception of the larger fruits, such as apples, etc. One characteristic of the climate which is extremely favourable to growth conditions is that 75 per cent of the precipitation takes place during the six months from April to September.

Nationality of Settlers in Vicinity of Country Examined.—From Ste. Anne, south and east to the United States boundary, the settlers are nearly all French and French half-breeds. Along the Whitemouth and Birch rivers south of the Grand Trunk Pacific railway the land is occupied exclusively by Galicians, Ruthenians and Poles. The country in the vicinity of Whitemouth is a German settlement, while St. George, on the Winnipeg river, is peopled altogether by French Canadians who settled there about 1887.

Classification of Country.—This region may be divided into three distinct districts according to soil conditions and the concomitant timber conditions. These are as follows:—

- I. Prairie Region.
- II. Transition Area.
- III. Laurentian Region.

PRAIRIE REGION.

Topography and Drainage.—As shown on the map, the eastern boundary of the prairie lies approximately in the vicinity of the Brokenhead river. From here the prairie stretches westward. Along its eastern edge it is slightly rolling, but it rapidly levels down, forming part of the great inland plain. The plains are drained by rivers and creeks decidedly less numerous than in the rough rolling Laurentian country, and differing from them in their almost imperceptible current and meandering course. The valleys of these streams vary in width and depth according to the size of the streams, while the banks are usually steep and clean cut.

Geology and Soil.—The prairies are underlaid with beds of sandstone and limestone deposited in the great inland sea during the Cretaceous period. Covering this is a mantle of boulder-clay and gravel, which was formed during the Ice Age, when that great glacier slowly moved southward, grinding down hills, scooping out hollows and depositing the acquired till when its progress was retarded by the tempering of the climate.

The top layer of sand and clay, which is the subsoil of this district, was then formed by the overworking of these boulder-clays. As the great glacier receded, a large body of water (Lake Agassiz) was formed along its front, which covered the greater part of Manitoba and a large part of Minnesota. Through the action of running water these boulder-clays were sorted and then deposited in the quiet waters of that lake as gravel, sand and clay. The essential or distinguishing characteristic of the prairie soils is the large proportion of vegetable matter and the concomitant nitrogen which they possess. This is due to the growth, fall and decay of the rank vegetation, which flourished there for many generations.

The inestimable value of the prairies as an agricultural resource is known the world over, and need not be dwelt on here.

TRANSITION AREA.

Boundaries.—This region is bounded on the west by the prairies and on the east by the rough rocky Laurentian country. Grading along its western border into the prairies and on the east into the Laurentian type, this strip of country extends southeasterly across the border into the United States.

Altitude.—The average altitude runs from about 800 feet in the northern part to 1,100 feet in the south and east, while in the Cypress mountains, near Badger, an altitude of 1,250 feet is attained. In no part, however, is there sufficient variation in altitude to have any influence on the occurrence of frosts.

Topography.—This area may be briefly described as a broad muskeg plain, sloping slightly to the north and west, with the monotony broken at intervals by gravel and sand ridges. These ridges consist of eskers, moraines and drumlins, wherein is well exemplified the power of glaciers to modify the land surface.

Drainage.—Over 75 per cent of this area, consisting chiefly of muskegs, lies in the drainage basin of the Whitemouth river. This river, rising near the United States boundary at Whitemouth lake and following a very tortuous course, flows almost due north, bordered on either side by muskegs for the greater part of its length, from here to where it enters the Winnipeg river, about sixty miles in a direct line. Whitemouth lake is almost surrounded by muskeg, the shores of which are floating bog, and, with only three to six feet of water on a bottom of silty, slimy material, is very typical of a lake on the height of land in a muskeg district. The river on leaving the lake is only about eight feet wide and three feet deep. Its volume steadily increases as it is joined by the numerous streams tributary to it, the two largest of which are the west branch of the Whitemouth and Birch river, until, where it enters the Winnipeg river, it is about 300 feet wide.

The Lake of the Woods claims the drainage from the eastern part of these muskegs, while the Roseau and Rat rivers on the south, the Seine and Brokenhead on the west, and Catfish creek and the Winnipeg river receive the drainage from the remainder.

The lack of drainage is the feature which determines the type of vegetation most prevalent in this region, namely, the muskeg type. Insufficient drainage is here due to an impenetrable subsoil of boulder clay, hard-pan, or, in a few places, bog-iron ore, as well as the lack of gradient.

Geology.—The geological formations in this section are identical with those of the eastern part of the prairie except that the three layers which cover the original Archean rock, viz., the Cretaceous sandstones and limestones, the glacial till, and the subsoil of overworked glacial material gradually become thinner as one travels eastward, and, on approaching the western rim or border of the Great Laurentian Shield, they disappear almost entirely. The latter two layers occur only over limited areas in the Archean country.

Trails.—A network of wagon trails, which can be used throughout the year, covers the high land, while the muskegs have numerous roads which make admirable winter hauling-roads for the lumberman.

Alienated Land.—The total land held under title within this transition area comprises about ten townships or about ten per cent of the total area. Part of this land has been "Swamp Land" purchased from the Provincial Government, while the remainder has been homestead land. This land which has passed from the Crown is shown on the accompanying map.

FACTORS DETERMINING TYPES.

The nature of the soil and the drainage conditions are the two factors of growth which determine the various types of forest found here and also on the Laurentian country to the northeast. Fires have been influential as well in changing a spruce type to one of poplar and also in destroying the humus which improves the growth conditions to such an extent. Summing up, it may be said that the soil (drainage being a factor of soil conditions) determines the type of forest vegetation, the result being modified by the action of fires.

TYPES.

The following types of forest may be definitely distinguished:—

1. Jack pine.
2. Poplar.
3. Muskeg { Open muskeg.
Lightly timbered muskeg.
Heavily timbered muskeg.

TABLE No. 1.—Area and Percentage Distribution of Types.

	Area in Sq. Miles.	Percentage of Total.
Total	3,816	100
Jack pine	287	7
Poplar.....	767	20
Muskeg	2,762	73

Jack Pine Type.

This type, which is found on the sand and gravel ridges, includes a large part of the country through townships 5 to 10 in ranges 10, 11 and 12, also township 3, range 12, and township 4, range 11, as well as considerable along the Lac du Bonnet branch of the Canadian Pacific railway.

The total area covered by this type of forest is approximately 287 square miles, or 7 per cent of the district included in the "Transition Area."

The greater part of the jack pine area consists of a series of low rolling ridges, with occasionally a small plain a few hundred acres in extent.

The soil varies from fine to coarse sand and may be classed as site I for jack pine. There is a small area, especially in the vicinity of the southeast part of section 8, range 9, in which the soil consists of fine and coarse gravel and larger boulders which may be classed as site II. The inferior growth conditions are well exemplified here in the short scrubby trees. There is no site III here, as there is on the barren rocks to the northeast.

The soil on these ridges grades from fine sand, through coarse sand and fine gravel to coarse gravel and, over limited areas, a boulder-strewn surface. The boulders are of granite and gneiss, ranging from six inches to several feet in diameter.

There is practically no humus at all in the jack pine type, except probably a small quantity in the hollows where the contour of the surface facilitates the collection of vegetable matter. The lack of humus here is no doubt due to the sparse ground-cover of small plants and to the small quantity of litter produced by the jack pine as well as to its rapid disappearance by decay, which is hastened on the porous soils where there is a free circulation of air.

The ground-cover is sparse, owing to poor growth conditions. The few plants found there are chiefly lichens, strawberry (*Fragaria*), Horse-tail (*Equisetum*) and various species of Composite.



(Photo L. C. Tilt)

Plate 2. Sandy Land with Jack Pine Reproduction along Dawson Trail.
Note glacial boulders.

The underbrush is also sparse; the only plant appearing to any extent is the several species of blueberry (*Vaccinium*), which attains its best growth in the jack-pine type and in some places a dense cover is formed from which the inhabitants derive considerable revenue by marketing the berries.

TABLE NO. 2.—Stand Table Showing Average Number Per Acre of Trees of each Diameter Class in Jack-pine Types.

Based on measurement of 12.5 acres. Average number of trees per acre, 114.02.

Diameter at Breast-height outside bark.	Jack Pine.	Poplar.
Less than 4 in. and over 3 ft. high	64.2	8.2
4	31.1	0.02
6	8.7	
8	1.6	
10	0.2	

Over all of this type the jack pine occurs almost always in pure stands. There are occurrences of jack pine mixed with poplar, but these are very much in the minority. Poplar occurs only sparingly in this type, but when present also occurs chiefly as pure stands.

For the purpose of describing the density of the stand in this type, it may be divided into two classes: First, that part which through repeated burning has been gradually converted from a jack-pine stand to prairie,* with only an occasional



Plate 3. - Jack Pine Prairie.

(Photo L. C. Tilt.)

This type of country, the effect of repeated fires, is rather common throughout the proposed reserve.

scrubby tree or even with no trees whatever. These patches of prairie-like land occur only in small areas, from an acre up to a few acres in extent. This condition is found scattered through the jack-pine type wherever it occurs, and includes about 15 to 25 per cent of the jack-pine type. The remainder of this type is clothed with a rather dense stand of jack pine, having, in technical language, a density of from 0.6 to 0.8.

The greater part of the timber here is in the age-class, 0 to 20 years. On a good site a tree 6 inches in diameter at breast-height and 40 feet high will be about 30 years old.

There is very little reproduction in this type, due, no doubt to there being no fires of any account for the last ten years. The seedlings which were present have grown to saplings, which are present in rather open stands.

The stands of jack pine are thrifty except where fire has wounded the trees. Then, of course, there is little growth. The lack of density also has an untavourable influence on the stand, producing short, open-grown trees instead of long clear boles, the trees 4 to 6 inches in diameter at breast-height being only 25 to 35 feet high.

The poplar which grows here is still more affected by the same influences, viz., fire and lack of density, and therefore produces only small scrubby timber.

Practically the whole of this area has been burned over within the last 25

* By the word "prairie," it must not be gathered that prairie soil-conditions are implied as well as surface conditions. The soil is sand and therefore unfit for agriculture.



(Photo L. C. Tilt)
 Plate 5. Jack Pine along Dawson Trail,
 Township 7, Range 10.



(Photo L. C. Tilt)
 Plate 4.—Open Stand of Jack Pine Poles,
 Township 7, Range 10.

years, so that all that is now found is young growth. There has also been considerable of the jack-pine timber type converted to prairie through the action of constant fires.

This type is utterly unsuited for agriculture on account of the sandy soil. Supporting only a limited flora, the most prominent members of which are the jack pine and the accompanying shrubs and herbaceous plants, (blueberry, horsetail, strawberry, sand cherry, etc.) this soil lacks growth conditions favourable to plants such as are desired by the agriculturist.

Elsewhere in this report there is a suggestion that a large continuous area of this type be set aside for a Forest Reserve.

Poplar Type.

This type occupies the heavier soils which have a proportion of clay as well as a quantity of the finer sands and some silt. In a few places also it occurs where the ground-water level is closer to the surface than in the jack pine type.

This type covers about 767 square miles, or 20 per cent of the total area.

The most prominent species at present is poplar, which occupies about 80 per cent of the area. The white spruce covers about 15 per cent, while tamarack makes up the remainder.



Photo L. C. Tilt.

Plate 6. White Spruce Reproduction around Abandoned Homestead.

Although poplar is now the prevailing species on the poplar type, there seems to be little doubt that white spruce is the climax forest over this area, or, in other words, that if this area were protected from all unnatural changes, such as fire, lumbering, etc., the stand which would be present after a few generations would be the same as formerly, viz.: pure white spruce, being the ultimate creation of the various growth-factors of the site.

The evidence which indicates that this transition from one type of vegetation to another has taken place in this district is very striking. First, there are several small islands still remaining which have not been burned over, and so consist of pure spruce, while the brûlé on all sides is poplar. Secondly, a great deal of the poplar has a fine undergrowth of young white spruce, which is rapidly gaining

headway and after twenty or thirty years will no doubt overtop the poplar; the latter will die off, leaving once more the original climax forest of pure spruce.

The land occupied by the poplar is slightly less rolling than the jack-pine ridges. Poplar also occupies nearly all the depressions of any size, where there has been a greater tendency for clay and the finer sands to be deposited.

The soils, as before mentioned, are made up of the finer sands with a mixture of silt and clay so that these soils grade into loams and clays.

They usually are coloured to a depth of four to six inches by the admixture of decomposed leaves and branches. The subsoil is practically identical with the soil except for the absence of the vegetable matter.

The humus, as a rule, consists of well decomposed vegetable matter to a depth of one to two inches covered with a layer of litter of leaves and branchlets to a thickness of two inches or more.

The ground-cover which may be classed as fairly dense here consists of bunchberry (*Cornus canadensis*), sarsaparilla (*Aralia*), strawberry (*Fragaria*), violet (*Viola*), wild pea (*Lathyrus*), besides grass, ferns and moss. (See Frontispiece.)

The underbrush covers a large part of the soil, specially the youngest brûlé, which has a dense cover of the smaller woody plants, consisting of hazel (*Corylus*), mountain maple (*Acer spicatum*), wild rose (*Rosa*), willows and the highbush cranberry (*Viburnum*), along the hay meadows and in the willow bottoms, along the creeks.

The greater part of the poplar type, probably 75 per cent, consists of poplar timber of a rather scrubby nature. The following stand-table gives an idea of the relation of the quantities of different species and their sizes:—

TABLE No. 3.—Stand Table Showing Average Number of Trees Per Acre of each Diameter-Class in Poplar Type.

Average number of trees per acre, 105.78.

Diameter at Breast-height.	Poplar.	Spruce.	Balsam Fir.	Birch.
Inches.				
4.....	52.1	13.2	0.01	4.2
6.....	30.6	0.01	0.01	1.4
8.....	4.2			
10.....	0.02			

The poplar usually occurs as a pure stand, but occasionally the admixture of tamarack, spruce and birch which are present, make up 20 per cent of the total number of stems.

The density of the young scrub poplar on the brûlés is about 0.3, while in the older stands, which are decided exceptions here, the density may rise to 0.7, although it averages 0.3 to 0.6 and consequently short, much-branched timber is the result.

The greater part of the timber is in the lower age-class, viz., 0 to 20 years. That found over 20 years is a very small part of the total.

No special study was made of the growth of poplar, but the few observations made showed the height at five years to be about five feet and the growth after that age up to twenty years about a foot per year in a stand of medium density.

A thick stand of young poplar begins to show itself soon after a fire on the better soils. The young spruce do not appear, however, until the poplar has attained a height of 10 to 20 feet.

The conditions for favourable growth in this type are present only over limited areas because of the open stands which produce the open-growth scrubby trees.

Fires, frost and fungi have done considerable damage among the poplar. Fires have modified the original type here to such an extent that hardly any of its features is now present. The original, or climax, type on this site was, no doubt, a pure stand of spruce. After a fire, the poplar, which in its youth is a very rapid grower, would soon cover the area. The young spruce may come in later, but another fire would soon destroy the seed-bearing spruce trees so that soon there would be no seed to reproduce that tree over the area. The poplar, on the other hand, having a very light seed which is easily carried by the wind, would soon take possession of the whole country.

Frost has also done much damage in this type. The balsam poplar, or balm of Gilead, the species most susceptible to this agency, is affected to a considerable extent, especially along the streams. A study of this showed that from thirty to fifty per cent of the larger trees (above four inches in diameter at breast-height) are badly cracked by the frost.

Of the fungi, two are specially destructive. The False Tinder Fungus (*Fomes igniarius*), which is so prevalent on the poplar in all parts of Canada, changes the wood to a white pulpy mass. It has affected from twenty to thirty per cent of the aspen and was also found on the balm of Gilead. The Heart-rot (*Fomes nigricans*), in its transformation of the wood and partly in its sitting body, resembles the former fungus; it is also very common among aspens. The fruiting body of this fungus is very black in colour and much broken up into small irregular patches.

Muskeg Type.

This type, which is omnipresent in this district, is equally common along the border of the Great Laurentian Shield, which extends from the north of the Woods northwest along the Winnipeg river to Lake Winnipeg.

This type includes all that land which lies near the level of the lakes or lakes, as well as practically all the watersheds, or heights of land, which are perceptible in crossing from the head of one stream to another. Although accurate measurements were taken regarding the slope or gradient of the watersheds, practically all seemed to have a decided dip from the level, which over a distance of a mile was easily perceptible to the eye. The current seen in some of the streams and ditches through the muskegs also indicated a decided slope. This gradient in some places would be as much as 0.2 per cent. Of course, there are areas which are almost perfectly level, but they are in the minority; these are mostly small areas less than half a mile wide, and as a rule surround floating bogs.

Drainage is the one factor of soil conditions which here assumes great importance. This factor, unaided, has been the cause of the peculiar peat and the growth conditions peculiar to muskeg formation. Lack of drainage may occur in one of two ways: first, in a pot hole which has been the result of glaciation; second, where there is very little slope and probably an impenetrable subsoil of clay which will prevent subterranean drainage.

The layer of decomposed vegetable matter here which takes the place of soil can hardly be called by the name of soil, since it contains no mineral matter at all except the small quantity which is included in the composition of vegetable matter and probably a small portion deposited from the ground waters. It should properly be called peat.*

* Peat is the partly decomposed vegetable matter containing less than 1 per cent mineral matter or none at all. Muck is more nearly decomposed and contains 5 to 25 per cent of mineral matter.

Where a muskeg is found with a considerable slope, the lack of drainage is likely due to an impenetrable stratum of boulder-clay, stratified clay or probably bog-iron ore, the last-named having been deposited from the ground-waters through the action of the humic acid formed by decaying vegetable matter. A cross-section of the peat or partly decomposed vegetable matter will show it to be covered at the surface with green sphagnum moss; lower down, although the mass is composed of the same individual plants, these have lost all life and have been bleached of their colouring matter. Still farther down, the peat gradually loses the features distinguishing it as a vegetable matter until, several feet down, the fibrous mass can hardly be distinguished as vegetation at all.

Sphagnum moss is the one plant which is universally present on muskegs, not only here but all over the Northern States and Canada. Besides several species of sphagnum, there are also usually present hypnum and polytrichum, two other mosses, besides the low bush cranberry (*Vaccinium oxycoccus*), winterberry (*Ilex*), pitcher plant (*Sarracenia*) and orchids (*Orchis*).

The swamp birch (*Betula pumila*) is the most abundant species of shrubbery covering the muskegs. There are also present however, Labrador tea (*Ledum*), leather-leaf (*Cassandra*) and the snowberry (*Chionoxia*).

Muskegs are rather free from fires on account of the damp situation. There are several examples, however, in this district, where a lightly timbered muskeg has been converted into an open muskeg by the action of fires.

The larvæ of the large larch sawfly (*Nematus erichsonii*), which defoliates and thereby kills the tamarack, have done a great deal of damage. They are responsible for the death of 25 to 50 per cent of the tamarack in this type.

The dwarf mistletoe (*Arceuthobium pusillum*) is responsible for large brush-like growths occurring on the black spruce and occasionally on the white spruce as well.

AREA AND PERCENTAGE DISTRIBUTION OF MUSKEGS.

	Area.	Percentage of total.
	Sq. Miles	
Total	2,762	100
Heavily Timbered Muskeg	1,600	57
Lightly Timbered Muskeg	1,000	37
Open Muskeg	162	6

*Heavily Timbered Muskeg.**—The common species here are tamarack and spruce, but, bordering on the jack pine and poplar types, white cedar is found and occasionally a few small paper birch, while in extreme cases an occasional balsam of Gilead or balsam poplar grows. This region is the northwestern limit of growth of the white cedar, which is found only as single trees north of townships 59 and 60.

There may be some objection to the classification of a tamarack swamp as a muskeg. Tamarack swamp, so-called, is, however, the last step in the evolution of plant and of soil conditions which goes on in muskegs.

There are two conditions under which this type exists, viz., (1) near the edge of a muskeg, where the peat overlies the subsoil to a depth of not more than about three feet; (2) where the original hollow has been entirely filled with vegetable matter and so a solid foundation is formed and increased growth follows.

* In surveyor's reports and by people generally this is referred to as "tamarack swamp."

The true "tamarack swamp" occurs only over limited areas as overflow land along a stream. Here there is no layer of peat, but usually an abundant growth of ferns with underbrush of willow and dogwood.

The tamarack-spruce areas occur in the heavily timbered muskeg, usually as a mixed type. Occasionally a small island of pine-spruce or pine-tamarack is found, but this is an exception, and is found only along the margin of that type, showing the transition of one type into another.



Plate 7.—Pure Tamarack Muskeg along Whitemouth River.

(Phot. L. C. Tilt.)

TABLE No. 5.—Stand Table Showing Average Number Per Acre of Trees of each Diameter-Class in Heavily Timbered Muskeg Type.

Based on measurement of 18 acres. Average number of trees per acre, 146.0.

Diameter at Breast-height Outside Bark.	Tamarack.	Black Spruce.
4	16.2	5.2
6	29.1	8.5
8	36.2	6.2
10	28.7	2.1
12	12.2	
14	1.6	

There are in the muskeg type occasional areas of pure tamarack. The following table shows an average-acre stand of this kind:—

TABLE No. 6.—Table Showing Average Number Per Acre of Trees of each Diameter Class in Pure-Tamarack Muskeg Type.

Based on measurement of 6.5 acres. Average number of trees per acre, total, 127.4.

Diameter at Breast-height Outside Bark.	Tamarack.
4.....	11.3
6.....	22.7
8.....	41.6
10.....	20.8
12.....	16.2
14.....	7.9
16.....	5.6
18.....	1.3

(Average height of trees 10 to 16 inches, 50 to 65 feet.)

Density in the heavily timbered muskeg varies from 0.5 to 0.7 over the whole area. Of course, islands of pure spruce will have a density of 0.9, but this is only over very limited areas.

The age varies from seedlings to 150-year-old trees. These latter, in the case of spruce, would have a diameter of about 10 inches at breast-height and a height of 50 feet. A 50-year-old tree would be about 3 inches in diameter and 20 feet high.

The tamarack does not grow quite as fast as the black spruce; a 50-year-old tree would be about the same size, but a 150-year-old tree would be about 9 inches in diameter. In the poplar type, however, a 150-year-old tamarack would be about 12 to 14 inches in diameter at breast-height, this fact indicating the superior growth-conditions of the poplar type.

This type may be classed as site II for tamarack and black spruce. Tamarack are found growing on a better site, i.e., in mixture with poplar. The black spruce cannot compete with the other species on the better sites, hence is found only on the poor sites.

The reproduction of both species is rather poor within the muskeg itself, but as one approaches the borders, it improves very much. From this it may be deduced that the muskegs are probably growing larger and encroaching on the other types, although the growth-conditions approach more closely to those of the open bogs.

The density is sufficient to warrant fine clear boles in the mature timber, both the larch and spruce being clear of limbs for about 30 feet. The growth-conditions, however, are unfavourable, as about 15 to 20 years are required for a 5-inch tree to grow to the 6-inch class.

Lightly Timbered Muskeg.—This subtype covers about 1,000 square miles, or 40 per cent of the total area of muskeg in this district.

It differs from the heavily timbered muskeg in the size and density of the timber, as the name would suggest, and also in those conditions which bring about this difference of growth in the timber. The timber on this type seldom attains a size greater than 3 to 4 inches in diameter at breast-height and 25 feet high, and grades down to mere shrubs a few feet high. The difference in growth-conditions is chiefly the lack of drainage and the more acid and cold soil that goes therewith. The density of this type is much less than in the heavily timbered type, being from 0.2 to 0.5; in fact drainage conditions are so poor that this type is very similar to a floating bog in many portions.

This subtype would be classified as a poorer site than the heavily timbered muskeg, and therefore may be taken as site III.

The slope or gradient will be found to be practically zero, since country of this type is almost a floating bog.

The underbrush, although consisting of the same species as the former subtype, is decidedly more dense on account of the open growth of timber. While the same tree species—tamarack and spruce—are found here also, there is a tendency for the tamarack to predominate and even in many cases to grow in pure stands.

The typical timber-growth here is a pure stand of tamarack, averaging about 1 inch in diameter at breast-height and about 10 feet high, growing in a rather open stand.

Several plots taken in this type showed an average of 580 stems per acre, average diameter at breast-height 1 to 1.5 inches, average height 10 to 15 feet.

These tamarack saplings are from fifty to a hundred years old and only about an inch in diameter. Very often it is impossible to discern the annual rings of growth, even with a hand lens. Hence it is very evident that growth-conditions are very poor and timber of commercial size would never be produced.

Open Muskeg.—This term is usually synonymous with floating bog. There are a few places, however, where open muskeg resulted from a timbered muskeg being cleared by fire, instead of being the result of unfavourable growth conditions.

An open muskeg may be briefly described as a quaking bog containing only an occasional tree or no trees whatever, and covered with grass and reeds and considerable "buck birch" (*Betula pumila*).

This subtype includes the remaining muskeg, viz., that which has not been accounted for in the two types which are more or less timbered, and comprises about 162 square miles, or 5 per cent of the total area.

Small groves of spruce and tamarack are found scattered throughout this type, where a knoll or rock rises to the surface, making a solid foothold for tree growth.

The large area of open muskeg near the junction of the two branches of the Whitemouth river is much broken by ridges which are very typical drumlins and eskers, indicating the severe glaciation to which this country has been subjected.

As mentioned before, this type contains no timber whatever, being like open prairie.

Disposal of Muskegs.—Land with growth-conditions similar to those found at present on the muskegs is of no use for agriculture; nor can timber be produced on any of it during a reasonable time. On part of it no timber production is possible.

The drainage of these muskegs would not lessen the flow of water in the Whitemouth river sufficiently to lower the water table on the farms adjacent to it, and thereby cause a lack of moisture in the soil. If such was found to be the case, however, it would be a simple matter to reserve an area of muskeg surrounding Whitemouth lake to perpetuate the water-supply of that river.

If conclusions can be drawn from what has been done under similar conditions in Minnesota, it seems very probable that, if this land were drained and cleared and a small amount of fertilizer used, crops could be raised which would rival those of the prairies.

Drainage Possibilities of Muskeg.—Lack of drainage may be brought about by three causes:—

1. Lack of gradient.
2. Enclosure in a pot-hole.
3. Presence of an impenetrable subsoil.

These may all be overcome by digging a network of ditches to allow the water to run off, thereby lowering the water-table and hence allowing the peat to dry up.

The question of the possibility of using this peat soil for agriculture, although still not definitely decided, is beyond the theoretical stage.



Plate 8.—Walking Dredge at Work on Open Muskeg.
(Tp. 4, Rge. 7, east of Principal Meridian.)

(Photo L. C. Tilt.)



Plate 9.—Ditch Dug by Walking Dredge, Showing Road Alongside Made with Earth Removed.

(Photo L. C. Tilt.)

Probably the best example of what can be done on a muskeg soil, is to be seen at Island, Minnesota, where the Hon. G. G. Hartley, of Duluth, has drained and brought under cultivation several hundred acres of muskeg. Besides being interesting from this point of view, Hon. Mr. Hartley's farm is one of the finest in the state of Minnesota. The land was originally a muskeg with varying density in the timber from open muskeg to heavily timbered. Two large state ditches ran quite close to the property. Two more large ditches were cut through the land to be drained. Lateral ditches were then dug, draining to these main ditches. This partly decomposed vegetable matter varied from three to eight feet deep. The land was cleared and dragged several times to bring roots to the surface, and these were then piled and burned. After this peaty-like "soil" had been exposed to the air for a few weeks it was easily pulverized and became more like soil. It was found that fair crops could be grown without a fertilizer, but with the aid of chloride of potash, of which \$3.25 worth was used per acre annually, an exceptionally fine crop was produced. Practically all farm crops are grown, the soil being especially applicable to garden crops.

There are several other places in that state where a small amount of drainage has been done. In fact, the state of Minnesota has done more work in the drainage of muskegs than any other state in the Union, and since conditions there are so similar to those met with in Manitoba, a great deal of valuable information can be gathered there.

At Marchand on the Canadian Northern railway there are at present four townships (townships 4 and 5, ranges 7 and 8) being drained by an American firm under the supervision of Mr. F. E. Davidson. The work here is being done by a walking dredge, which will "walk" ahead and dig about a mile of ditch per week, the ditch being from ten to fourteen feet wide and four to six feet deep. The earth is taken out and dumped along the side of the ditch, where it is levelled and a road is made of it. Crops of timothy, barley and flax were seen growing on a drained muskeg here, which speaks highly for the nutritive value of the soil.

Owing to the limited data procured regarding the muskegs, as, for example, depth to subsoil, chemical properties of peat, plant food, gradients, etc., it would be absurd to suggest that this muskeg consisting of over 2,500 square miles as shown on the accompanying map be drained to be used for agriculture. It does, however, warrant suggesting that an investigation of the agricultural possibilities of this district be made with a view of draining and farming these muskegs, and for this purpose, as before mentioned, a study of conditions in Minnesota will be a valuable aid.

LAURENTIAN AREA.

The Laurentian Area, which covers so large a part of Canada (over fifty per cent of the total area), extends southwest into this part of Manitoba. In this district the southwestern boundary of the Laurentian country may be described by a line drawn from the mouth of the Winnipeg river in a southeasterly direction to the northwest arm of Lake of the Woods, which is known as Falcon lake. Northward and westward this type of country extends to the mouth of the Mackenzie river, north to the Arctic ocean and east through Ontario, Quebec and Labrador. With the exception of a small area of sedimentary rock around Hudson bay this whole area is included in, and composes, the "Great Laurentian Shield."

Altitude.—Along the Ontario-Manitoba boundary from Falcon Lake north to Cross and Crow Duck lakes there is an area of about 1,500 square miles of Laurentian country, which varies from 1,000 feet to nearly 1,200 feet above sea-level. The remainder of the area here, and extending up along the east shore of lake Winnipeg, has an altitude of from 750 to somewhat less than 1,000 feet.

Topography.—The Laurentian Plateau may be considered as a topographic unit, its chief feature being those of a peneplained region of crystalline rock (granites,

gneisses and schists, severely glaciated and thereby denuded of the mantle of residual soil).

The topographic feature pre-eminent in the Laurentian region is the remarkably even sky-line, the character of which is not altered in spite of the great diversity of rock structure and hardness which occurs. Almost all over the tract, the horizon, as seen from an elevation, is almost as level as that of the sea and also like that of the sea is circular.

Over a small area and in detail, the surface is much broken and very uneven, but in a broad view it is strikingly flat and plateau-like. The degree of evenness may be appreciated from the fact that differences of elevation of from 80 to 100 feet in a ridge or knoll are visible for many miles.

Another extremely important feature of this region is the immense number of lakes studded with rocky islands, and the accompanying network of water-courses.

The slope, in general, of this area is to the north and west, the land falling at an average gradient of eight feet to the mile, which is at least double the grade over most of the Laurentian country farther north, and which accounts for the wonderful source of water-power on the Winnipeg river.



(Photo C. Tilt.)

Plate 10.—Whitemud Falls on Winnipeg River.
This fall of 21 feet is capable of developing 38,000 horse power.

The immense number of small pot-holes, the result of severe glaciation, is the factor determining the numerous muskegs, a few acres in extent, which dot the surface of this type of country.

Drainage.—The whole of this part of the Laurentian area drains into the basin of the Winnipeg river. The only rivers of any importance tributary to that river are the Whiteshell river, which joins it in township 14, range 14, the Whitemouth river, which drains the muskegs to the south, entering it at township 13, range 11, the Oiseau (Bird) river, which drains into Lac du Bonnet at its eastern extremity, and Maskwa (Bear) river, which joins it near its mouth in township 18, range 10.

The water-power capable of development on the Winnipeg river is considerable in quantity. This resource is of much greater value on account of its proximity to the city of Winnipeg. Within the province of Manitoba, the Winnipeg river con-

tains eleven falls with an average of over 22 feet fall, capable of a total development of about 400,000 horse-power. Of this, only 46,000 horse-power are developed, which is in use by the city of Winnipeg. At Point Du Bois, there is a generating station developing 25,000 horse-power of the 83,000 which it is capable of producing. At Pinawa, the remaining 21,000 horse-power which is produced furnishes power to the Winnipeg Electric railway.

Geology.—The geology here is typical of all the Laurentian country. Two limited areas of Huronian formation are present. One extends as a narrow tongue along the Oiseau (Bird) river in township 17, range 13. The other is near Falcon lake, in township 8, range 17. These consist of hornblende-schists and light chlorite schists, which are cut by quartz veins carrying gold to a slight extent, similarly to a great deal of the Laurentian country west of Lake Superior.

The Star Lake Mining Company is at present doing some development work in the vicinity of township 9, range 17.

With the exception of these two small areas of Huronian rock, the whole district is underlaid with a fine-grained rock, which, although granite in appearance, is gneissic in structure, of a pink or light red colour.

Soil.—Another feature peculiar to the Laurentian country is the scarcity of soil. Practically all of the residual soils, the result of the various agencies of decay on the underlying rock, have been removed through severe glaciation. They have not only been graded down into the hollows but have been transported southward by the great glacier. Many of the hollows are as devoid of soil as the ridges and knolls, which are almost entirely bare. However, along the valleys of streams and on the southern exposure of many of these ridges, there is considerable soil, consisting chiefly of gravel and coarse sand, the fragments of which are angular. This latter fact indicates that their formation has been due, not to the action of water but rather to glaciers. Along the streams where all the best timber is found, the soil, being alluvial, contains considerable clay and finer sand, so that it is decidedly more fertile than the gravel previously mentioned. Of the total land surface within this district, there is about 15 to 25 per cent which is rock outcrop, and probably 50 per cent of the total area has soil considerably less than 12 inches in depth.

Method of Travel.—With the network of waterways, which penetrates to all parts of this district, as in all Laurentian country, and makes it par excellence the greatest country in the world for travel by canoes, there is no need of trails. The only trails which are present are the portages, which transform the water routes into continuous routes of travel.

Damage.—Fires have repeatedly swept the whole of the country timbered with jack pine, as well as all of the smaller muskegs and areas of spruce and poplar. There is not more than two to five per cent that has not been so over-run and this small area consists chiefly of the larger areas of muskeg.

Consequently, what remains is young growth, the greatest part of it in the youngest age class of from 0 to 20 years. It has not only destroyed the old timber, but the repeated burning has destroyed what little vegetable matter existed, so the remaining soil, exposed to the action of the wind, has been transported to lower levels. Accordingly, there is now but a sparse reproduction of the jack pine, which once formed a fairly complete forest cover. The spruce has been destroyed and in its place is found a growth of young poplar which is acting as a nurse crop for the young spruce which is again coming in, and which will in the future be the climax forest on the better soils, if protected from fire.

The larch sawfly, as in the other types, has made its destructive effects seen here.

The resin midge has also been doing considerable damage in the terminal branches of the young jack pine.

Frost-crack is very prevalent in the balsam poplar (balm of Gilead) along the streams. From 25 to 50 per cent of the trees are affected.

Classification into Types.

This district may be classified into three main types, namely:—

1. Jack pine.
2. Poplar-spruce.
3. Muskeg.

While a small area is occupied by what may be called the Willow type.

Jack-pine Type.

This type includes all those areas which are almost devoid of soil and those where the soil that is present is very coarse. About 50 per cent of the total area is included, comprising the coarse soils as well as those areas where the soil is very thin and also the small areas of barren rock.

The drainage of the soil in this type is too rapid on account of the rolling country and very porous soil. There is practically no humus, which is due to the small quantity of litter produced by the jack pine and to its rapid decomposition and disappearance on a porous soil. The ground-cover is also sparse, consisting of several species of lichens, of which reindeer moss (*Cladonia rangiferina*) is probably the most important. There are also flowering plants, among which are saxifrage (*Saxifraga*), harebell (*Campanula rotundifolia*) and columbine (*Aquilegia*). The underbrush consists of raspberry (*Rubus*), juniper (*Juniperus communis*) and wild rose (*Rosa*), which form rather a sparse covering.

The tree species composing this type are jack pine and poplar, with a few black spruce in moss-covered areas. This may readily be called a pure type, as any species but jack pine is an exception. It is probably 90 per cent pure. Since there are numerous small areas, which consist of bare rock, on which nothing can grow, the density of the whole type will be affected. All these areas of bare rock which are over one-quarter acre in area would total about 15 to 25 per cent of the jack-pine type. Of the remaining 75 to 85 per cent the density may be said to be about 0.3 to 0.5. Practically the whole of the young stand of jack pine on this type is included in the age-class from 0 to 20 years. In dense stands of saplings 2 to 3 inches in diameter at breast-height, sample plots have shown as many as 4,000 stems per acre. An average of the whole area would show 600 to 800 per acre, less than two inches in diameter at breast-height. Reproduction of jack pine always follows a fire where the timber which has been burned is of sufficient age to produce seed. Frequently, too, there is sufficient seed lying dormant in the ground to produce a good crop of seedlings after a fire. The reproduction of jack pine is, no doubt, favourably influenced by a fire, which probably opens the cones, and cracks the seed-coat, thereby allowing the seed to germinate, as well as exposing mineral soil. The growth conditions are slow on so poor a situation, which may be termed site III. On account of the lack of density the timber produced is apt to be short and limby, but in spite of this it is a valuable asset to the country to have a soil which will produce timber of any kind whatever, when it is utterly unfitted for anything else.

Poplar-Spruce Type.

This type covers the southern exposures along many of the ridges, as well as much of the low land, where a part of the residual soils removed by the glaciers has been deposited and where there is also some alluvial soil. It includes about thirty per cent of the Laurentian country. The drainage as a rule is good, except that along the water-courses there is danger of overflow. The ground-cover is fairly dense, consisting of ferns and flowering plants, such as bunch-berry, sarsaparilla, strawberry, etc., similar to the plants found in the poplar type within the transition area. The underbrush here is also similar to that previously described as occurring in the transition area, viz., high-bush cranberry, raspberry, willow and alder.

The tree species found here are aspen poplar, white spruce, balsam poplar (balm of Gilead) and black spruce, with an occasional tamarack and white elm. Of these, the aspen includes 60 to 80 per cent of the total number of trees, while the others make up the balance. Over the greater part of the area a pure stand of poplar may be said to prevail, although there is considerable spruce, a small part of which is mature timber, the greater part being young growth coming up beneath the poplar. The density of this type varies from 0.3 to 0.6. The most of the young poplar is in the age-class, 0 to 40 years; a few of them are 40 to 60 years old. Then, of course, the few mature stands of spruce will run from 60 to over 100 years old. The repro-



(Photo L. C. Tilt.)

Plate 11.—Poplar Land Cleared for Homestead, along Oiseau (Bird) River.

(Tp. 17, Rge. 13, east of Principal Meridian.)

duction of poplar is good and that of spruce is improving rapidly, indicating that the climax forest on this type, as well as in the transition area, is no doubt a pure forest of white spruce. The poplar is growing at a very reasonable rate, but for years to come it is doubtful whether it will be useful for lumber or fuel. However, it is forming an admirable shelter for the young white spruce which is developing.

Muskeg.

Muskeg occupies two situations in this district. It is found in pot-holes, where drainage is impossible on account of the impenetrable rock subsoil. It is found also along streams, where there is very little gradient, and at the heads of lakes which are no doubt in the first stage of that evolutionary process which is slowly changing the whole, or probably only part, of the lake into a floating bog.

It includes about twenty per cent of the total area. The ground-cover, underbrush, etc., are similar to those muskegs previously described in the report, sphagnum being predominant in the ground-cover. The only trees found in the muskeg are the black spruce and tamarack and occasionally a small paper birch. Mixed stands of tamarack and spruce are the rule, but in small muskegs of an acre or so, a pure stand of spruce will usually be found, tamarack seeming to thrive better in deeper

soils. The general description of this type may be regarded to be similar to that of the medium timbered muskegs in the Transition Area, which it very much resembles.

Willow Type.

Although occupying only a small area, probably about 1 to 2 per cent, this type includes the best alluvial soil in the district, lying along water-courses, especially at the confluence of two streams. The soil consists of glacial material overworked by the water action and deposited as a heavy clay or loam soil. The mantle of decayed vegetable matter covering it makes it extremely fertile. The fertility is evidenced by the rank growth of red-top (*Agrostis alba*) and other wild grasses. There are two subtypes of this main type: first, meadow, partially or wholly covered with willow and red dogwood brush, and second, open hay meadow.

SUITABILITY FOR A FOREST RESERVE.

This Laurentian country is evidently totally unsuited for agriculture. The only other alternative is to protect the young growth thereon, so as to produce timber, which will help to supply the market, which the ever increasing use of wood is developing and which is rapidly depleting the supply.

Although the examination made of this section of the Laurentian country has been rather superficial, it has been sufficiently close to warrant the suggestion that it be set aside as a forest reserve.

The examination has been too cursory, however, to warrant setting down a line to be taken as the southwest boundary for this proposed reserve; but, in general, the line will be as shown on the accompanying map, as the southwestern edge of the Laurentian district, extending from Falcon lake (in township 8, range 16) north and west across the Winnipeg river to a point near the mouth of that river at Fort Alexander. The country for about two to five miles on either side of this line will have to be examined, to definitely locate the line which will divide the agricultural and non-agricultural land and at the same time to indicate the southern boundary of this Laurentian forest reserve. The presence of frequent muskegs along this proposed line is a hindrance to an efficient survey during the summer. The best time to do this work is beginning in the fall, immediately after the freeze-up, when the muskegs facilitate rather than hamper the reconnaissance of such a district.

From what can be gathered from surveyor's reports and from Indians and other persons acquainted with that part of Manitoba east of lake Winnipeg and north of the Winnipeg river, one would conclude that it is of little use for agriculture. The country may be briefly described as a more or less level country of low rocky ridges, sparsely covered with soil, bearing a very limited growth of small jack pine. The ridges are separated by muskegs, variable in extent from a few acres to several square miles. On either side of the water-courses there are strips of fair agricultural land from one-quarter to one-half mile wide, which is the only land that could be used for farming at all. The rocks and these muskegs are evidently not suited for farming. The necessary examination of this country east of lake Winnipeg will procure the information and data which will no doubt determine it as absolute forest soil, and warrant setting it aside as a forest reserve.

NEW FOREST RESERVE.

An area of sandy soil of considerable extent which has been described previously in this report under the heading "Jack-pine Type," lies in the vicinity of range 10, north of the Canadian Northern railway. This soil is too sandy to be of any use for agriculture but nevertheless can produce a good growth of jack pine. Therefore, to set this aside as a forest reserve, whence in future years the surrounding population will be able to procure firewood and building timber, is no doubt the most feasible disposal which can be made of this area.

Although sufficient time was not spent in this district to give the exact location of the boundary of such a tract, an approximate boundary is here suggested which may have to be altered in a few places when a closer examination is made.

The following boundary is suggested:—

Beginning at the northeast corner of section 21, township 4, range 9, thence east 8 miles, thence north 13 miles, thence east $7\frac{1}{2}$ miles, thence north 3 miles, thence east 1 mile, thence north 1 mile, thence east 5 miles, thence north 3 miles, thence west 5 miles, thence north 2 miles, thence west 1 mile, north 1 mile, west 12 miles, south 1 mile, west $1\frac{1}{2}$ miles, south 3 miles, east $1\frac{1}{2}$ miles, south 9 miles, west $1\frac{1}{2}$ miles, south 1 mile, west 1 mile, south 1 mile, west 1 mile and south 8 miles to point of beginning.

TABLE NO. 7.—CLASSIFICATION OF TYPES.

The types met with in this proposed reserve and their areas are as follows:—

Type.	Area in Square Miles.	Percentage of Total.
Total	260	100
Jack Pine.....	150	58
Poplar.....	65	21
Muskeg.....	65	21

Over 50 per cent of the jack-pine area in the whole district described is included within this proposed reserve. Therefore the description of the jack-pine type previously given in this report, which was based partly on this area, is applicable here, as are also the descriptions of the other types.

Within this area recommended for reservation there are three actual homesteaders. There have also been several other homesteads taken up, but these have been abandoned.

Trails.—In the jack pine through townships 5 and 6, range 10, there is a network of wagon roads which as a rule are in very good condition. In section 29, township 7, range 11, these trails join the Dawson road, which is an exceptionally fine road running completely across this area in township 7. There are several other trails which cross muskegs and are, therefore, passable only in the winter.

Ranger Stations.—There are several fine sites for a ranger station, with a good supply of hay and water close at hand. These are in section 8, township 7, range 11; section 28, township 6, range 10, and the best one is in section 14, township 7, range 11, where the Dawson road crosses the Whitemouth river.

Fire Protection.—If a fire-ranger is placed in this area to watch people who travel through, there should be little danger from fire. During the past there has been no one near to extinguish fires, which were left to burn. The chief cause of fires is the blueberry pickers and hunters. In the northeast quarter of section 12, township 8, range 9, there is a very fine site for a lookout tower from which nearly the whole area could be patrolled.

Game Protection.—The chief species of game in the area is the prairie chicken, which is found in the open jack pine and scrub. There are also a few red deer and an occasional moose and black bear.

If all game, in this section to be reserved, were protected for a few years, it would soon be well stocked with the game previously mentioned, and, if protected for a considerable length of time, the chickens would rapidly increase and begin to stock the country surrounding it.



(Photo L. C. Tilt.)

Plate 12. —Stand of Jack Pine of Pole Size, with Open Park-like Stand in Foreground.



(Photo L. C. Tilt.)

Plate 13.—Meadow on Dawson Trail at Ford of Whitemouth River.
This is a fine site for a ranger station

APPENDICES.

NOTE ON LEGISLATION AFFECTING SWAMP LANDS.

The "Better Terms Act" of 1885 provides that all Crown Lands in the province of Manitoba, which may be shown to the satisfaction of the Dominion Government to be swamp lands, shall be transferred to the province and enure wholly to its benefit and uses. To carry out this provision of the Act, Swamp Land Commissioners were appointed to make inspection, and lands of which more than half the area is subject to overflow during ordinary prevailing conditions were to be classed as swamp lands. Up to 1890 the selection was by legal subdivisions, for the next ten years by quarter-sections and sections, and then by legal subdivisions again. In all, 2,593,627 acres were selected as swamp land, and of these 2,012,416 acres, being found available in the records of the department, were transferred to the province of Manitoba.

Under the provisions of the Manitoba Boundaries Extension Act of 1912, which provides that all swamp lands transferred to the province and not sold by the Provincial Government shall be retransferred to the Federal Government, about 1,163,980 acres are now being revested in the Dominion. This, together with lands classed as swamps, found vacant in the records of the department, but not transferred, gives an area of approximately 1,400,000 acres of land classed as swamp held by the department. These lands are principally in townships 1 to 18 in ranges 7 to 14, east of the principal meridian, and townships 17 to 32 in ranges 1 to 2 east of the principal meridian, and 1 to 23 west of the principal meridian.

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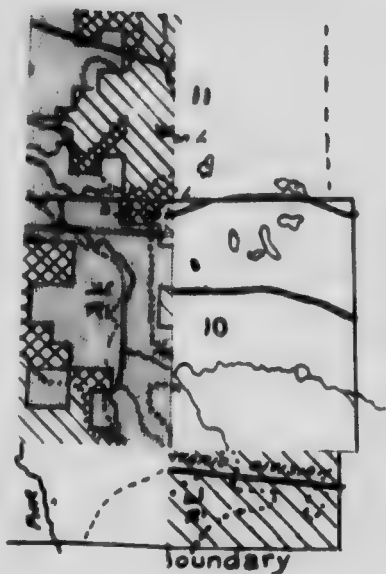
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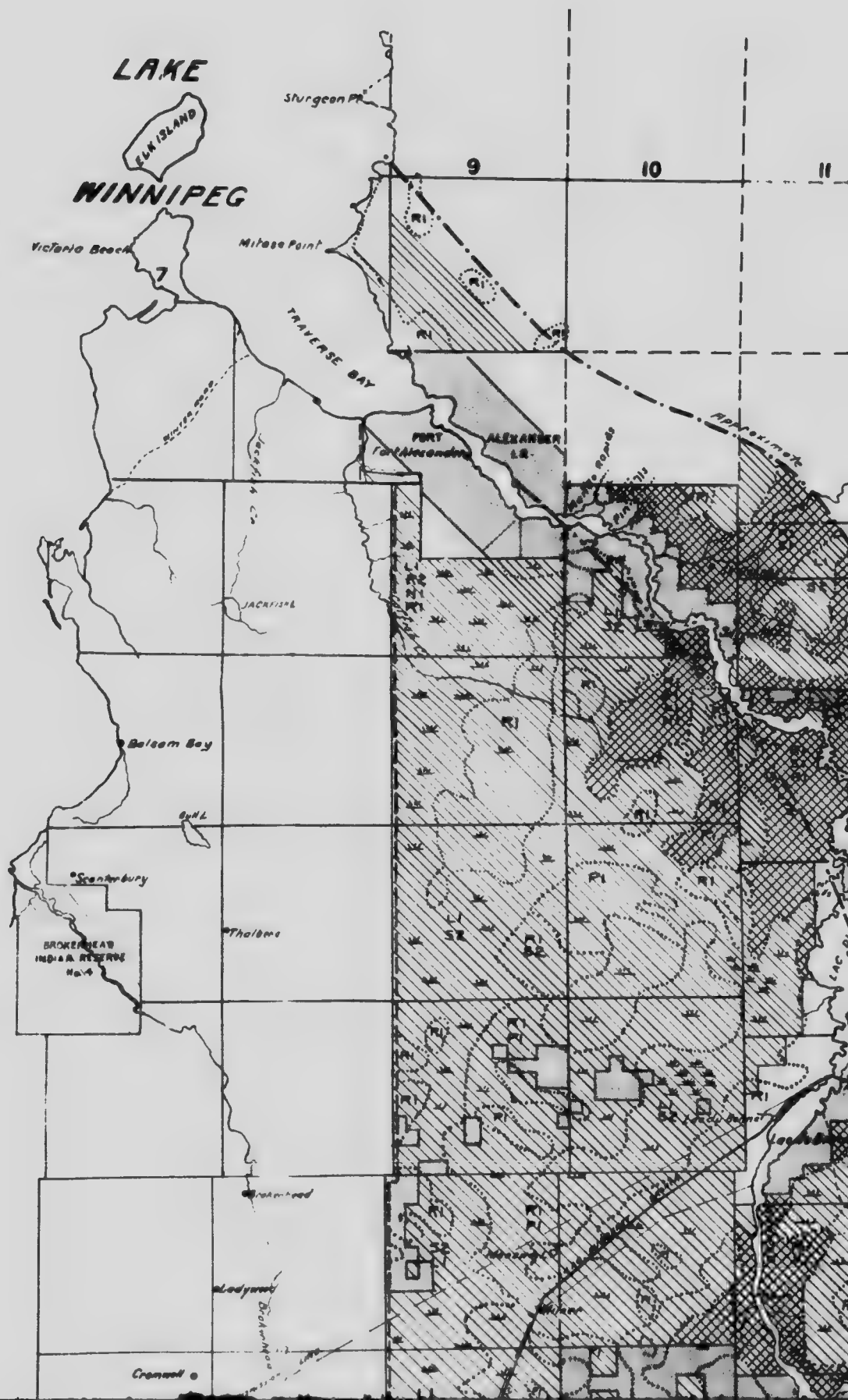
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PLAN
OF
LANDS EXAMINED
IN
SOUTH-EAST MANITOBA
SHOWING
PROPOSED FOREST RESERVE

Examined in 1912 by - L. C. Tilt, B.Sc. F.

Compiled by - B. R. Martin B.Sc. F.

- | | | |
|---|--|-------------------------------|
|  Woodlands, cordwood, poles etc. |  Grassland | P - Jack Pine |
|  2000-5000 B.F. per acre |  Muskegs, sloughs, etc. | A ₁ - Aspen |
| L ₁ - Tamarac | S ₁ - White Spruce | S ₂ - Black Spruce |
| | T ₁ - White Cedar. | |

 Lands held under title







